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PRELIMINARY MEDICAL EDUCATION[1]

AMONG medical men interested in the advance of their profession few questions are attracting more attention at the present time than is that of the character of their professional education, and going a step farther, it might be said that opinion is now pretty well settled on this point that the important part of the medical education is the beginning of it, or perhaps better, the preparation for it.

Questions of the relations of medical education to medical practise have been discussed by college faculties, medical societies, state boards of examiners and other bodies, and out of all their discussions some tangible results are beginning to follow, as shown by the rapidly increasing requirements for entrance to or graduation from medical schools, which are now insisted upon by those in authority. Recently, through its Council on Medical Education, the American Medical Association has begun to take a very active part in the discussion, and will undoubtedly exert a great influence in shaping opinion. The association has had for years a committee on education, but as the membership changed from year to year, little of real value was accomplished. In 1904, however, a permanent body known as the Council on Medical Education was created, the functions of which are to determine the actual condition of this branch of profes-

[1] Based on a Report to the Council on Medical Education of the American Medical Association, presented April 29, 1907.

sional education in the United States, and make recommendations for its improvement. The council has held three conferences, the last one of which was in Chicago in April.

An important feature of this conference, which was attended by eighty-four delegates from various schools, societies and examining boards, were the reports made by the chairman, Dr. A. D. Bevan, and the secretary, Dr. N. P. Colwell, on the results of a personal inspection recently made of the one hundred and sixty medical schools of the country, with respect to their facilities for doing the work for which they are chartered. Many of these schools were found to be sadly lacking in everything considered essential in an educational institution, and exist merely as commercial ventures. It may be safely said that fully one half of our medical schools have no moral right to exist. Some of these are an actual menace to the public good. The report of the chairman took up also the questions of curriculum and standards in medical education. It emphasized the fact that the most serious problem confronting the schools of medicine in this country to-day is that of the entrance requirements. Various recommendations for the advancement of these were made.

Leaving out of consideration the fraudulent commercial concerns masquerading as schools or colleges of medicine, it can not be questioned that many of the really meritorious institutions are attempting to do more in four years than can be successfully accomplished with the student body as now constituted. In the last two or three decades scientific medicine has made enormous strides, and the majority of entering students are not properly equipped to take advantage of all that is offered them, especially in the newer pathology and etiology. The developments in physiological chemistry and bacteriology have brought new ideas into the science, and to comprehend them, and make practical use of them the young man beginning the study of medicine must bring to his work a far better preparation than was thought necessary ten or fifteen years ago. It has frequently been suggested that in order to give more time for this training a fifth year should be added to the medical curriculum; in other words, the course should be made to cover five years in place of four, and in the freshman year the work should be wholly scientific. In principle this suggestion is not bad, but, unfortunately, few medical schools seem willing to accept it. On the other hand, the great majority of medical teachers insist that the work of the medical school should be in the line of professional, and not preparatory, study, and that all really general or preliminary work should be done before the medical school is entered. The extent of this preliminary work is now the problem to settle.

An ideal condition would seem to be this, that the student should complete a four years' course for the bachelor's degree before taking up the medical course of four years, but few institutions are prepared to make such a requirement, and the situation in Johns Hopkins Medical School and Harvard Medical School can not be duplicated elsewhere in this country for some years. In fact, it is often asserted that the conditions of medical study in these schools are *not* the ideal conditions, and although excellent, are not in every way desirable. This view, which I may say I do not fully agree with, is based on certain facts which must not be lost sight of. These are some of the facts: It is everywhere apparent that the most highly educated physicians are not always the most successful in the practical treatment of disease. Over-education creates in many men a sort of therapeutic skepticism which is a decided drawback in every day practise. In spite of our great

advances in knowledge there is still much in medicine that is empiric, and a quick intuition and sympathetic manner may go further than actual scientific ability. A large part of every-day practise is country or village practise, and among a class of people who do not care for or understand refinement of any sort. Among such people general culture is not appreciated and may even be a detriment to actual success. This may sound paradoxical, but the observation has been made over and over again that the rough-and-ready man who is familiar with the language of the field and shop and who can speak it with the people is successful, where the user of the choicest English may fail utterly, not, of course, because of the English, but because of acquired mental peculiarities which may go with it. The practitioner can not be too far ahead of the people with whom he has to deal. Considering practically the medical man's patrons, it must be admitted that in the United States his income is *relatively* low. Of course I am not thinking here of the fortunate surgeon who has achieved a reputation in a large city and whose fees may be anything he chooses to ask, but I refer to the every-day practitioner of general medicine, the man who has been called the family physician, and who is expected to attend to all kinds of ailments. For the time he spends and the work he does his pay is far from high, and possibly not high enough to warrant a longer time in preparation. From what was intimated above, it does not follow that a longer course of study would bring greater pecuniary reward. Wages of those who work with the hands only have advanced more rapidly than has the somewhat uncertain income of the professional man.

With these and similar facts before him the young man through with the high school hesitates at the outset of a course which may lead him through eight years of work before he begins to earn a living, and, all sentiment aside, that is what most men have to work for. And medical men who have been at the grind for years, also hesitate in recommending such a course of study. What preparation, then, can be made for the medical school which is more in harmony with actual conditions if not with ideals? Is it possible to find a compromise course which will mark an advance, and yet not be so extensive as to be impracticable?

At the present time the best of our medical schools seem to require graduation from a four years' high school course for matriculation, and this, we are all agreed, is not enough. Many authorities are asking that, following the high school course, two years of regular college work should be taken before the regular medical course of four years is begun. This is probably a just requirement, but it appears to be still in advance of what may be insisted upon. As a compromise the Council on Medical Education has recommended a preliminary year of work in sciences and language, in addition to the high school course of four years, as the practical minimum which should be accepted by medical schools in good standing. A very considerable number of the best schools have promised to adhere to this scheme.

In order to work out some of the details of such a plan a special committee on preliminary medical education, consisting of Professors George A. Piersol, of Philadelphia, Charles R. Bardeen, of Madison, and the writer of this article, was appointed last fall, and has since made a brief report with some recommendations. At the outset, it may be said that the members of this committee, as individuals, are agreed that a four-year college course preliminary to medicine is an extremely valuable acquirement, and should be recommended wherever

possible. We are agreed, also, that two years of college work are better than one, when devoted to preliminary scientific study. But in favoring and urging a one-year course as outlined below we are working on a perfectly definite proposition on which the leading medical schools may be able, for the present, to unite. For the moment we are interested in this question: What should be considered as a year of work in science and language, valuable as a preliminary to medical study, and how may this work be taken? Some time before the appointment of our committee the council made a direct effort, through correspondence with a number of the more prominent universities and colleges of the country, to discover the amount of work which should be considered as a year's equivalent in the several topics, and how much of this work in sciences and languages could be completed in a single year at the various institutions addressed. In other words, it was sought to learn how far the usual, or an elective, freshman course would go toward satisfying the requirement of the council with reference to this preliminary year.

The replies received by the secretary, Dr. Colwell, were far from satisfactory; in fact, in many cases they were very misleading and gave no clear idea of what the universities could do in the matter which would be of value in helping on with the plans of the council and the medical schools interested in the proposition of raising the standard of work in medical education. It was even evident that in some of the answers the university and college authorities had dodged the issue.

With these facts in view our committee decided to ask for more definite information, and in such a way as to leave no loophole for misunderstanding. Accordingly, the following circular was printed and sent to all the colleges, universities and technical schools listed in the last report of the Commissioner of Education. There are about 500 names in the list, and the circular letter was sent out in February last.

THE CIRCULAR LETTER

CHICAGO, Feb. 25, 1907.

Dear Sir:—Because of the rapid advances made in medical science in the last ten years it is becoming necessary to greatly increase the work given to students of medicine to enable them to take advantage of the modern points of view and follow understandingly the many valuable recent discoveries. It is not possible to increase the work within the limits of the four-year courses as now given in our best schools of medicine, as these courses are already overcrowded. On the other hand, it does not appear to be at present possible to lengthen these courses to five years, as has been sometimes suggested. The only remaining alternative is to require of students beginning the study of medicine a broader preliminary training than is usually called for from young men or women entering the medical school. This training should embrace some of the work now given in the medical school in the first or freshman year, with certain subjects in addition, and may be outlined as follows:

1. A year's work in general biology.
2. A year's work in chemistry.
3. A year's work in physics.
4. A year's work in a modern language, preferably German.

All of this work is supposed to be of the grade given in the freshman or later years of our best colleges. It may be and should be preceded by elementary high school work in the same subjects, especially in the languages. It is understood that a year's work which may be counted toward the bachelor's degree is the equivalent of four recitations or lectures a week in each of four subjects through the usual nine months' course.

The following statement may make clearer what is understood by a year of college work in the several subjects:

Biology.—The course here should include lectures or recitations, and laboratory exercises amounting to about six hours of work a week through one college year. In the laboratory the following types, or their equivalents, should be studied: (*a*) a protozoon (a ciliate and ameba); (*b*) a celenterate (hydroid, hydra or sea-anemone); (*c*) an annelid (earthworm); (*d*) an

arthropod (preferably a decapod); (*e*) a vertebrate (preferably a frog or fish), with a view of a general comparison of the plan in internal structure with that of the human body. When possible a study of tissues should be made, first with the unaided eye and then with the microscope, to demonstrate the relation of cells to intercellular substance, as in epithelium and connective tissue. It is desirable that the students should study other fresh typical specimens of elementary tissues, as muscle, nerve and blood.

If the college work in biology is wholly or largely of a zoologic character, as outlined above, it is desirable that it should have been preceded by some work in botany in the high school.

Chemistry.—The student entering the medical school should have completed a substantial course in general inorganic chemistry, with experiments, elementary qualitative analysis, an outline, at least, of volumetric analysis, including the theory of the fundamental processes, and finally, a short course in organic chemistry sufficient to serve as an introduction to physiological chemistry. All this work in chemistry should consume, at least, about ten hours of recitation and laboratory work per week through a year.

Inasmuch, however, as few freshmen courses cover as much ground as is here indicated, the work in general inorganic chemistry, with laboratory experiments and qualitative analysis, may be taken at present as the minimum amount which would satisfy the needs of the medical schools under the new requirement.

Physics.—This college work is supposed to be preceded by an elementary or preparatory course in the high school or academy. The subjects here of the greatest importance for the study of medicine are heat, light and electricity. Satisfactory work in these branches should cover probably three recitation hours and five or six laboratory hours through a college year. The student should acquire some practical knowledge of the microscope, the spectroscope, of thermometry and specific heat, and some familiarity with simple electric measurements.

Languages.—In addition to the work of the high school or academy in these subjects the student should have enough college training to enable him to read one foreign language, preferably German or French, with some degree of ease.

Up to the present time most of our medical schools have drawn their students from the graduates of the high schools. A few medical schools have required college graduation for entrance, but it is recognized that this relation is not yet, in general, realizable. It is hoped, however, that in order to meet the urgent demand for better preliminary education now being made by the leading schools of medicine, the colleges of the country will be prepared to furnish in the first years of their courses to prospective medical students such a curriculum as is outlined above.

This letter is sent out by a committee of the Council on Medical Education of the American Medical Association in an effort to discover just what the colleges of the country can do for the instruction of this class of students who usually do not enter college at all, but who now, under the press of changing conditions, must do some college work before being considered properly prepared to enter upon the study of medicine.

Will you kindly answer the following questions:

How much of the work outlined above is your institution prepared to give in *one year* to students who have a high school training?

How much of this work can you give in *a year and a half*, that is to the middle of the sophomore year, to students equipped in the same way as above?

If not at present able to furnish the courses in the specified time, can you, in view of the apparent demand, give such courses beginning with the college year 1908–9?

The point to be kept in mind is that the college should be able to furnish this desired instruction within a period corresponding to the freshman and perhaps a part of the sophomore year. A blank is enclosed for a reply, which will be greatly appreciated, as will also any comments or suggestions which you may make.

In presenting its report the committee desires to prepare for publication a list of those colleges which are or will be able to offer courses substantially like those outlined above.

Yours truly,

C. R. BARDEEN,
G. A. PIERSOL,
J. H. LONG,
Committee

The phrase "preliminary year in biology, chemistry, physics and languages" is somewhat vague, and the committee, after much discussion, undertook to define it to some extent, as appears in the wording of the circular letter. To be of real value the courses taken in a preliminary year should

make it possible for the student to begin a higher grade of work immediately after entering the medical school. At the present time most of our medical schools teach the elements of biology, chemistry and physics, and it is probably no exaggeration to say that two thirds of the time of the medical freshman is taken up with work which may be, or in fact should be, done elsewhere, and better, too.

It was this consideration which led our committee to outline in a general way what should be covered in the several preliminary courses. It will be seen that the suggested exercises in biology cover work which would serve as a beginning in histology and physiology as well as in comparative anatomy; the chemistry work would cover that given in our usual medical freshman year, while the courses in physics would take the place of work now given in a perfunctory way in many of our medical schools, but which is becoming every year more and more necessary as the many relations of this fundamental science to medicine become more and more tangible.

A modern German classification divides physiology into the two groups of studies comprised under the titles of bio-chemistry on the one hand, and bio-physics on the other. A glance through any one of the larger manuals of physiology in use in our medical schools discloses a justification of this division, and suggests also the desirability of relegating much matter from the class-room in physiology to the class-room in physics. Besides this, it is becoming evident that modern pathology is making every day wider inroads not only into the fields of chemistry, but also into the domain of physics, and taking all things together, the committee felt that it was not going too far in calling for the amount of physics suggested in the circular letter. No explanation of any length was made in reference to the language work, as little difficulty from this direction was expected.

RESULTS OBTAINED

Now as to the results. The replies received were 215, of which the larger number were plain and satisfactory; a few were not as clear as might be desired, from which it follows that a perfectly sharp classification can not be made from the data secured. But the results are close enough for the present purpose. Sixteen of the answers came from state universities, 8 from agricultural and technical schools and 191 from other institutions, some of which include the best-known colleges and universities in the country. The replies from 15 of the state universities and from 7 of the agricultural and technical schools showed a good general agreement with our proposed courses of study. The replies from 78 other institutions were also favorable, although it appears likely in a few cases that the schools in question have not the facilities for properly doing the work called for. On the other hand, about 30 well-known institutions made replies which could not be looked on as wholly favorable.

The situation in some of the older schools seems to be best expressed by the comments made by President Hadley of Yale, as follows:

> The demand for places in our undergraduate courses is so far in excess of what we can readily meet that we can hardly arrange to take men for one year, with a view of letting them leave us at the end of that time. We must, I think, arrange our courses for men who expect to stay longer.

In this list along with Yale we must place Cornell, Princeton, Trinity, Williams, Lafayette, Union, Tufts, Vanderbilt, Bowdoin, Oberlin, Hamilton, Amherst, Syracuse and others of known rank. It is evident that the schemes of instruction in these schools are not flexible enough to

allow a freshman to elect as large an amount of work as our committee suggested. The greatest difficulty seems to be with the work in physics, which naturally presupposes some acquaintance with trigonometry, and which in consequence is usually thrown over to the sophomore year. The work in chemistry, biology and languages could in most cases be provided for.

HOSTILITY TO THE PLAN

The replies from about 80 institutions gave evidence of lack of interest in the matter, lack of equipment for the work, or, finally, a distinct hostility to the plan. As illustrating the last situation the answers from two small colleges, one in Pennsylvania and one in Illinois, may be quoted. The first reads as follows:

In reply to your letter I would say that we can not justly give the course you suggest in less than two years, except in rare cases. We have found, in our experience, that the students who took a full B.S. course received the best results. We even discourage the short two years' course, because it has so little of general culture work, and the American college stands for culture. If professions will continue to admit men on purely technical preparation and disregard the college, the college nevertheless must stand for the ideals that have made it. Your suggested one-year course is unpractical. You require so much laboratory work in chemistry and physics that none but the exceptional freshman can take them. The number of hours of your proposed course outnumber the hours which educators, knowing the capacity of the human brain and mind, have fixed as a maximum. Should your plan obtain the work must be superficial. *For some time we college men have watched the plans of the medical profession and we are astonished that there is so little appreciation of sound pedagogics.* (Italics mine.)

From the president of the Illinois school the following reply came:

In response to your inquiry concerning our work in science relative to its value for medical education, permit me to say that we offer all and more than you require, but not in the freshman year. We carry science study through four years of the college course. It appears to us on careful consideration that what you require as preliminary to the medical course could not be well crowded into one year. Three different lines of science study with extended laboratory practise is more than students can advantageously carry in one year, not to speak of the addition of a modern language. Certainly, such crowding could hardly meet the requirements of a good college course. Besides, freshmen are not qualified for the more advanced work in the sciences. Moreover, it seems hardly fair to us that colleges should be asked to do such hurried preparatory work for the professional schools. Why might not law and theology come with similar requests? In what manner could any college do justice to its students under such pressure? Would it not be perfectly fair for the professional schools to adjust their courses to the needs of college graduates? That would certainly greatly improve professional efficiency. We are quite ready to maintain such courses as the professional schools can recognize; but we can not see our way clear to comply with the requests of your letter of inquiry.

It is evident that these men do not fully understand the situation and in addition that their answers are dictated by a somewhat natural self-interest; but in the opinions of other men better able to appreciate our position, we have noticed a similar doubt as to the wisdom of attempting so much work in a single year. In this connection there are two questions to consider: first, the practical one of arranging hours to avoid a conflict of studies, and yet present all the work suggested to be taken, and, second, the possibility of carrying this number of hours successfully. In actual time the scheme provides for about 25 hours of work each week through the college year, divided between class-room and laboratory, and omitting organic chemistry. Now, allowing for a reasonable division of time in the work in the sciences, this is not more than a fair student should be expected to carry, and not more than students carry well in many of our best schools. It must be admitted that students

who are expected to devote a good fraction of their time to athletics and fraternity interests can not carry such courses, but we are far from believing that the present tendency in these matters in some of our schools is a desirable one or one which may be expected to persist.

The writers of many of the replies received by us seem to assume that the proposed preliminary science course is the work of medical practitioners who have devoted but little time to the study of working conditions, and further that the courses involve difficult or advanced scientific studies. Both notions are absurdly wrong and it is evident that the presidents of a few of the colleges are not very familiar with the work of our active medical men on the one hand, or with elementary scientific studies on the other. It may be added that the members of our committee are not practitioners of medicine, but we have drawn many valuable suggestions from practitioners as well as from teachers.

This work may call for more than one year's time from many students who attempt it, we admit, but that it is really more than can be accomplished in one year is not to be admitted yet. Any one who is familiar with science teaching will recognize that we have here merely the elements of such work, and it is a fact well known to many of us who have dealt with medical students for a number of years that some of the state universities actually give such courses, and successfully, to freshman students.

Our committee has been accused of advocating a departure from an "ideal" course. We have admitted all the time that the scheme is not perfect, but we are concerned with the practical question of what we can get, rather than with what we should like to have. I firmly believe that the difficulty is not so much with our proposed course as with the ideas which obtain in some quarters as to what is a fair amount of work for a young freshman who has completed four years of study in a good high school. I believe that with such a training honestly completed our schedule may be carried through in another year of college work. With this as a beginning, possibly in time a second year may be added to the requirement.

But the point of importance is the amount of work and not the name. The Council on Medical Education has spoken of it as a *preliminary year,* but if it actually calls for more than that time the student should be required to spend it, since it seems that little short of this would answer as a preparation for modern medicine. That the applicant for entrance to the medical school has this minimum amount of knowledge should be determined through the examinations of an independent board, and not through the professional school, or by certificate of the college or preparatory school. We all know what such entrance examinations amount to, and an important step forward will be taken when the right to enter upon the study of medicine, as well as the right to practise is passed upon by authorities other than the college faculties. The standard in such entrance examinations should be made as uniform as possible for the whole country, and to aid in bringing about such a desirable situation is one of the objects of the present movement.

J. H. Long

SCIENTIFIC BOOKS

Pragmatism, a New Name for Some Old Ways of Thinking: Popular Lectures on Philosophy. By William James. New York, Longmans, Green and Co. 1907. Pp. xiii + 310.

Tron de l'air! as I used to hear the Gascons of the *Quartier* exclaim, long ere I knew of

"toughs" and "tender-feet," of "Cripple-Creekers" and "Bostonians" in philosophy (p. 12 f.). The picturesque phrase springs to my lips again, set agog by the refreshing spectacle of a "big pot," as the English say, courageous and independent enough to avow himself an anarchist in things speculative (p. 28 f.). For Professor James bethumps the high priests, sacred and profane, of contemporary philosophy, with a kind of holy joy. And, so far as my limited observation goes, this joy is a pronounced and sprightly characteristic of "the oddly-named thing pragmatism" (p. 33). In a word, pragmatism has been misunderstood (p. 197), even made a mockery and jest (p. 233), as Mr. James alleges, because, to this point, it excels in the negative *nuance*.

Accordingly, I for one welcome this authoritative addition to the pragmatic canon if, peradventure, it may serve to unravel certain excusable puzzledoms. So, to begin with, What is pragmatism? Professor James directs the second of his lectures to this set question, with the following results:

> The pragmatic method is primarily a method of settling metaphysical disputes that otherwise might be interminable. . . . The pragmatic method in such cases is to try to interpret each notion by tracing its respective practical consequences (p. 45). Theories thus become instruments, not answers to enigmas, in which we can rest (p. 53). The attitude of looking away from first things, principles, "categories," supposed necessities; and of looking towards last things, fruits, consequences, facts (p. 54). Ideas (which themselves are but parts of our experience) become true just in so far as they help us to get into satisfactory relation with other parts of our experience (p. 58). Truth is *one species of good*, and not, as is usually supposed, a category distinct from good, and coordinate with it. The true is the name of whatever proves itself to be good in the way of belief, and good, too, for definite, assignable reasons (pp. 75–6).

Later, our anarchist, wishing doubtless to conserve his reputation, commits himself thus:

> Pragmatism, pending the final empirical ascertainment of just what the balance of union and disunion among things may be, must obviously range herself upon the pluralistic side (p. 161). Common sense is *better* for one sphere of life, science for another, philosophical criticism for a third; but whether either be *truer* absolutely, Heaven only knows (p. 190). The truth of an idea is not a stagnant property inherent in it. Truth *happens* to an idea. It *becomes* true, is *made* true by events. Its verity *is* in fact an event, a process (p. 201). "The true," to put it very briefly, is only the expedient in the way of our thinking, just as "the right" is only the expedient in the way of our behaving (p. 222).

Although, more than likely, I can not see these fluid matters from the pragmatic angle, "the pragmatic movement, so-called," which "seems to have rather suddenly precipitated itself out of the air" (p. vii), appears, *more Jacobo,* to embody a perfectly definite tendency. The "Anglo-Hegelian school" (p. 17) which has dominated the British universities for a generation, and energized mightily in certain American institutions, begins to pay the penalty of success and sacrosanctity. The bedewed gospel of the first generation has been overlaid by crystallizing commentary in the second. Hence, unmoved by the earlier enthusiasms and unaffected by their ramified causes, contemporary critics can stand forth unabashed and say of the "personal faith that warms the heart of the hearer" (p. 279): "It is far too intellectualistic" (p. 70); for it "truth means essentially an inert static relation" (p. 200); it rests "in principles after this stagnant intellectual fashion" (p. 95); "the theory of the Absolute, in particular, has had to be an article of faith, affirmed dogmatically and exclusively" (p. 159); "for rationalism reality is ready-made and complete from all eternity, while for pragmatism it is still in the making, and awaits part of its complexion from the future" (p. 257). On the whole, then, pragmatism betokens a protestant attitude towards such catholic tendencies and formulations of the orthodox university philosophy of the hour. In this respect, as Mr. James recognizes aptly on his title-page, it is nothing but "a new name for some old ways of thinking." To fine, the point, it is the familiar reaction of nominalism against standardization of experience according to archetypes "laid up in heaven." Never-

theless, it must not be confounded with its medieval, or even its British (Locke, Berkeley, Hume, Mill) forerunners; it does possess originality, just because it springs from present stress. The "new" astronomy, physics and chemistry, the sciences of life, above all, the amazing exfoliation of the human sciences, particularly psychology, forbid us to rest in Hegel, or even in "hegelisms" (a horrid word, Mr. James!) resurrected at Oxford after forty years and tricked out in the King's English. Pragmatism has the courage, the temerity, the "cheek," the "gall," the folly—call it what you like, to stand up and say "no." Meanwhile, the elementary condition of its logic, the vacuity (intentional, as some allege) of its metaphysics, and its besetting sin, confusion of psychological with epistemological problems, prevent it from settling down into any such sediment as might be labelled *universalia post rem*. Briefly, the pragmatic "things," which preexist principles and genera and species, are not "tea-trays in the sky," or even "black cows in the night," but rather palpitating human individuals gurgling along their several, and peculiarly private, psychological "streams." Pragmatism presents no commission to exalt objects at the expense of "universes," but it exhibits touching faith in persons as opposed to presumed spiritual unities that catch them up and carry them off willy-nilly. Here its "humanism" centers, and here its significance as a centrifugal force in current thought pivots. "Rationalism sticks to logic and the empyrean. Empiricism sticks to the external senses. Pragmatism is willing to take anything, to follow either logic or the senses and to count the humblest and most personal experiences. She will count mystical experiences if they have any practical consequences. She will take a God who lives in the very dirt of private fact—if that should seem a likely place to find him" (p. 80). Therefore, I would urge, let us listen to the new message, let us keep the ring in order that it may have free play to come to clear self-consciousness (cf. p. vii). Yet, let us feel free to put questions, especially very elementary questions. Mayhap pragmatism can open up a world of what it calls "the real," possibly it can bring us down from the dizzy realm of ideas and force us to revalue what it terms "the concrete phases of existence." But, at least, it must afford us every chance to ask what all this may be and purport. For, as the "rationalist" would quote,

I lived with visions for my company
Instead of men and women years ago,
And found them gentle mates, nor thought to know
A sweeter music than they played to me.

And visions come to all schools.

Thus, I rub my eyes when I read this: "When old truth grows, then, by new truth's addition, it is for subjective reasons. We are in the process and obey the reasons" (p. 63); and I inquire: How distinguish between "old" and "new" without something "purely retrospective" (p. 102) in which both share equally? What are these "subjective reasons" if there be no universe basal to subjective and objective alike—where do you catch the characterization? What is "the process" as distinguished from "we," and what the "reasons"? How do we get at either, if they have not "been already *faked*" (p. 249)? Once more: "The finally victorious way of looking at things will be the most completely *impressive* way to the normal run of minds" (p. 38). Very likely. But, what is "the normal run" as differentiated from the "minds"? If you *can* lay hold upon it, what becomes of your "noetic pluralism" (p. 166)? It won't do to run off airily on the declaration "that all things exist in kinds and not singly" (p. 208); for the *why* of the relation between "kinds" (which are not singles) and singles (which are never effective components of experience save in "kinds") is precisely the great problem of speculative thought. Again, Professor James writes, with admirable truth, "in every genuine metaphysical debate some practical issue, however conjectural and remote, is involved" (p. 100). But, then, if "we break the flux of the sensible reality into things . . . at our will" . . . if "we create the subjects of our true as well as of our false propositions" (p. 254), how are we to dis-

tinguish the "metaphysical" from the "practical"? Further, "I myself believe that the evidence for God lies primarily in inner personal experiences" (p. 109). What does this imply exactly? What are we forced to conclude as involved in the very possibility of the statement? It is all very well to hold that "the 'Absolute' with his one purpose is not the man-like God of common people" (p. 143); the problem remains, clamant as always. Where does the commonalty of this God find root? Meseems Mr. James himself can furnish forth reply: "The whole *naif* conception of thing gets superseded, and a thing's name is interpreted as denoting only the law or *Regal der Verbindung* by which certain of our sensations habitually succeed or coexist" (pp. 185–6). And, if so, is Mr. James not making common cause with the much derided "rationalists"? They, indeed, may have sacrificed "facts" to "principles," but pragmatists may all too easily sacrifice "principles" to "facts." And, after all, the traffic of philosophy is over the kind of universe in which it *has* so eventuated that facts and principles both disappear when separated. To appeal to the pragmatic method—if too much "ism" be bad for Green, it is equally bad for Mr. James. Thus the large riddle remains, Why are men always cozened by "isms"? Mr. James has not escaped the fate of more ordinary mortals. He writes sometimes like a gospeller; he would be a mediator; and when the gospel shall have been formulated, we shall know what pragmatism may import and where it proposes to take final stand.

Despite his humorous anarchism, Professor James has won to responsibility, and a book from his pen counts as an event. I am therefore bound to record the opinion that the present volume fails to rise to the level of its author's reputation. There is something too much of "the large loose way" (p. 215) about it. Of course, pages are illuminated by flashes from the psychologist whom we know and in whom we rejoice. Speaking of Leibnitz, he says: "What he gives us is a cold literary exercise, whose cheerful substance even hell-fire does not warm" (p. 27); he offers this really delicious etching of Spencer: "His dry schoolmaster temperament, the hurdy-gurdy monotony of him, his preference for cheap makeshifts in argument, his lack of education even in mechanical principles, and in general the vagueness of all his fundamental ideas, his whole system wooden, as if knocked together out of cracked hemlock boards" (p. 39); while these declarations remind one of many passages in the *Principles:* "The rationalist mind, radically taken, is of a doctrinaire and authoritative complexion: the phrase '*must* be' is ever on its lips. The bellyband of its universe must be tight. A radical pragmatist, on the other hand, is a happy-go-lucky anarchistic sort of creature. If he had to live in a tub like Diogenes he wouldn't mind at all if the hoops were loose and the staves let in the sun" (pp. 259–60). On the other hand, some cheap stuff, which one hates to see, has been allowed to creep in. Here is one of its mannerisms: "Pragmatism is uncomfortable away from facts. Rationalism is comfortable only in the presence of abstractions" (p. 67); "The more absolutistic philosophers dwell on so high a level of abstraction that they never try to come down" (p. 19); "the philosophy of such men as Green . . . is pantheistic" (p. 17). Here is another, and very different: "The actual world, instead of being complete 'eternally,' as the monists assure us, may be eternally incomplete, and at all times subject to addition or liable to loss" (p. 166); and here is a third, like unto the second: "Talk of logic and necessity and categories and the absolute and the contents of the whole philosophical machine-shop as you will, the only *real* reason I can think of why anything should ever come is that *some one wishes it to be here*" (pp. 288–9). To pirouette, even in a half-conscious way, between the substantive and transitive, the static and dynamic, the universal and particular, the one and many, may be a good "stunt" in a popular lecture-course, but one does not care to have Professor James stereotyped in this attitude. "Between the coercions of the sensible order and those of the ideal order, our mind is thus wedged tightly" (p. 211). Very true, very likely. But here

we are confronted with problems, and to suppose the statement fraught with solutions is to pay ourselves with words. In this very connection, the worst foes of pragmatism may be of its own household. The arrant rubbish now being piled up by certain pedagogical *chiffonniers*, for example, may prove far more fatal than all the flouts of the "genuine Kantianer" (p. 249). To the collectors of this stuff one can only exclaim with Touchstone, "truly, thou art damned, like an ill-roasted egg all on one side."

It surprises me, too, to see that Professor James exhibits some *naïevté* in his attitude towards the "rationalistic" school. "In influential quarters Mr. Schiller, in particular, has been treated like an impudent schoolboy who deserves a spanking" (pp. 66–7). Mr. James seems to have forgotten his previous remark: "No one can live an hour without both facts and principles, so it is a difference rather of emphasis; yet it breeds antipathies of the most pungent character" (p. 9). He can hardly be oblivious of the fact that a regnant intellectual or theological (ay, and scientific) group will stick at nothing to compass its ends. When its inner history—the pragmatic account of its persons—comes to be written, outsiders will be startled and disgusted to learn that the high-toned gospel of "self-realization" has been advanced by very common and very human methods. Innuendo, calumny, intrigue and even worse have played their several parts, while such persecution as the modern world permits has had free course. I am vexed to see that Mr. James has not learned to treat all this with the contempt it deserves, and has not preserved his charming humor to the extent of observing that it is as natural to man to "idealize himself into dirt" as into heaven. And this is the more to be regretted that British thinkers rather than American have been the marks for this refined mud-slinging.

Let me add, in conclusion, that pragmatism, as here outlined, may or may not be excellent science. Readers of SCIENCE must judge for themselves; those of them who are addicted to the fallacy of reification will find it a good cathartic. It is only raw material for philosophy. And, as I indicated above, I hope that, undeterred by pontifical anathemas, Professor James and his allies will proceed to *articulate* the philosophy which they believe themselves to possess. In any event, they are entitled to the satisfaction of knowing that, more than other contemporary groups, they contrive to keep the philosophical stream in sweetening motion. But whither it still remains for them to tell. So far as it has received voice, then, pragmatism is an avowed compromise. It is not beatified into a complete creation, attained and to be maintained. On the contrary, it rests a method of approach to thinking, especially from one incidental side. Whether it can overcome age-long antagonisms time alone will tell. In any case, it represents a real attempt at accommodation—a stage which, in the nature of the case, will pass away ere many moons. And then? Why, then, friend and foe alike will proceed to the *Bearbeitung der Begriffe*, a task rejected by these Lowell Lectures in rather cavalier style.

R. M. WENLEY
UNIVERSITY OF MICHIGAN

Catalogue of the Crosby Brown Collection of Musical Instruments of all Nations. III. Part I., Africa. New York. The Metropolitan Museum of Art. 1907. Pp. xxii + 79; pl. 26.

This is a new volume continuing the series of catalogues of this fine collection, to which there have been various references in SCIENCE from time to time. Gallery 37 is devoted to the "instruments of savage tribes and semicivilized peoples"; those from Oceanica and America will be dealt with in future volumes; the present one relates wholly to Africa. The "Egyptian type case" shows that most types of African and even European instruments were well developed thousands of years ago. The plates show a great variety of harps, lyres and lutes, as well as many forms of the curious Negro *Zauze*, sometimes misleadingly called "nail-fiddle" although the metal tongues are plucked, not bowed. (It is to be hoped that in a later edition the incorrect name

"key" for the vibrating tongues or bars of this instrument will be changed.) Flutes and similar wind instruments do not appear to be numerous or highly developed, but many horns, especially of ivory, are figured. The drum and the xylophone or *Marimba* require many pages.

The introductions and indexes are similar to those in former volumes and are good; the ethnographical notes are fuller than ever and add many interesting details.

CHARLES K. WEAD

WASHINGTON, D. C.,
June, 1907

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

SIX years ago the summer meeting and colloquium of the society was held at Cornell University. In the intervening years the Society has met successively at Evanston, Boston, St. Louis, Williamstown and New Haven. This year the summer meeting was again convened at Cornell University, on Thursday and Friday, September 5–6. Forty-seven members were in attendance. By close economy of time the scientific proceedings were condensed into two sessions on Thursday and a morning session on Friday. Friday afternoon was devoted to an excursion on Lake Cayuga, Mr. H. H. Westinghouse, of the university, having kindly placed his steam yacht at the members' disposal. The evening gatherings at the Town and Gown Club also furnished pleasant opportunities for social intercourse.

The first session opened with an address of welcome by Professor Wait, head of the university department of mathematics. At the close of the meeting resolutions were adopted expressing the society's appreciation of the generous hospitality of the university and its officers.

The president of the society, Professor H. S. White, occupied the chair, being relieved by Professors Fine and E. B. Van Vleck. The council announced the election of the following persons to membership in the society: Thomas Buck, University of Chicago; Arnold Dresden, University of Chicago; T. H. Hildebrandt, University of Chicago; W. J. King, Harvard University; J. O. Mahoney, High School, Dallas, Texas; J. F. Messick, Randolph-Macon College; H. W. Powell, College of the City of New York. Six applications for membership in the society were received. The total membership is now 569.

The following papers were read at the meeting:

L. E. DICKSON: "Modular theory of group matrices."

W. B. FORD: "Sur les équations linéaires aux différences finies."

R. D. CARMICHAEL: "On the classification of plane algebraic curves possessing fourfold symmetry with respect to a point."

R. D. CARMICHAEL: "Note on certain inverse problems in the simplex theory of numbers."

W. B. CARVER: "The ten special Γ_6^4,' configuration in the Pascal hexagram."

E. O. LOVETT: "Generalization of a problem of Bertrand in mechanics."

E. O. LOVETT: "The invariants of a group which occurs in the problem of n bodies."

E. R. HEDRICK: "A peculiar example in the theory of surfaces."

E. R. HEDRICK: "A smooth closed curve composed of rectilinear segments."

R. D. CARMICHAEL: "On certain transcendental functions defined by a symbolic equation."

D. C. GILLESPIE: "On the canonical substitution in the Hamilton-Jacobi canonical system of differential equations."

G. A. MILLER: "The invariant substitutions under a substitution group."

G. A. MILLER: "Methods of determining the primitive roots of a number."

VIRGIL SNYDER: "On a special algebraic curve having a net of minimum adjoint curves."

JAMES MCMAHON: "The differential geometry of the vector field. Second paper: lamellar field."

L. E. DICKSON: "Commutative linear groups."

L. E. DICKSON: "A simple derivation of the canonical forms of linear transformation."

EDWARD KASNER: "Geometric interpretation of integrating factors."

EDWARD KASNER: "The conformal representation of geodesic circles."

A. R. SCHWEITZER: "On the relation of right-handedness in geometry."

F. L. GRIFFIN: "On the law of gravitation in the binary systems, II."

F. L. Griffin: "Certain trajectories common to different laws of central force."

E. W. Davis: "Colored imaginaries. I, Imaginaries in the plane."

E. W. Davis: "Colored imaginaries. II, Imaginaries in space."

C. H. Sisam: "On the equations of quartic surfaces in terms of quadratic forms."

Virgil Snyder: "On the range of birational transformation of curves having genus greater than the canonical form."

G. A. Miller: "Third report on recent progress in the theory of groups of finite order."

Oswald Veblen: "Continuous increasing functions of ordinal numbers."

H. S. White and Miss K. G. Miller: "Note on Lüroth's type of plane quartic curve."

W. B. Fite: "Concerning the degree of an irreducible linear homogenous group."

Arthur Ranum: "Concerning linear substitutions of finite period with rational coefficients."

R. P. Stephens: "Certain curves of class n having $n-2$ tangents in any given direction."

A. L. Van Benschoten: "Curves of genus 4 which remain invariant under birational transformation."

M. E. Sinclair: "On a discontinuous solution in the problem of the surface of revolution of minimum area."

Maurice Fréchet: "Sur les opérations linéaires (troisième note)."

A. G. Greenhill: "The elliptic integral in electromagnetic theory."

The next meeting of the society will be held at Columbia University on October 26. The San Francisco section met at the University of California on September 30; the Southwestern Section will meet at Washington University on November 30, and the Chicago section at the University of Chicago on December 30–31. The annual meeting of the society will be held at Columbia University on December 27–28.

F. N. Cole,
Secretary

SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

Twenty-fourth meeting.—Carnegie Institution's Station for Experimental Evolution, Cold Spring Harbor, Long Island, New York. June 22, 1907. President Flexner in the chair.

Members present: Atkinson, Beebe, Carrel, Davenport, Donaldson, Ewing, Field, Flexner, Gibson, Gies, Hatcher, Lusk, Meltzer, Meyer, Shaffer, Wallace, Wadsworth.

Members elected: C. H. Bunting, Rufus I. Cole, Charles W. Duval, William W. Ford, Frederick P. Gay, Isaac F. Harris, James W. Jobling, Oskar Klotz, Paul A. Lewis, Thomas B. Osborne, H. T. Ricketts.

Abstracts of the Communications[1]

Demonstrations of Methods and Results of Pedigree-breeding of Plants and Animals: Charles B. Davenport.

Four series of pedigreed poultry were shown to illustrate certain laws of inheritance, as follows: (1) Darwin's case of "reversion," (2) The production of a frizzle-silky race, (3) Particulate inheritance of plumage color, (4) Independence in inheritance of the different characters.

There were also demonstrations of inheritance of characters in canaries, of Œnothera (evening primrose) and its mutants, of branching and branchless sunflowers, of variability of chromosomes in Œnothera and its mutants, and of inheritance of abnormal wing venation in the vinegar fly, Drosophila.

Further Studies of the Effects of the Exposure of Sperm to X-rays: Charles R. Bardeen.

Eggs of *Rana pipiens* fertilized by sperm exposed to Roentgen rays for one hour all develop abnormally. The abnormalities begin to appear during the gastrulation period. Cases of spina bifida are not uncommon. In a lot of several hundred eggs, nearly all of which were fertilized, only one specimen survived two weeks. This was much stunted in growth and very abnormal in shape. Of 80 eggs of the common toad exposed only 15 minutes to Roentgen rays only 4 larvas survived one month. Most of the larvas were markedly abnormal in shape. Of the sur-

[1] The abstracts presented in this account of the proceedings have been greatly condensed from abstracts prepared by the authors themselves. The latter abstracts of the communications appear in Number 7 of Volume IV. of the society's proceedings, which may be obtained from the Secretary.

vivors, two are large and apparently normal and two are undersized. Only one individual out of 150 eggs, fertilized by sperm exposed 37 minutes to the rays, has survived one month and this individual is only half the normal length and breadth. In a group of 250 eggs, fertilized by sperm exposed to Roentgen rays for an hour and ten minutes, all exhibited marked abnormalities of development and the least abnormal larva and longest survivor died a week after the eggs were fertilized.

The susceptibility of sperm of anura to X-rays is in marked contrast to that of paramecia. Exposure of paramecia for 12 hours to rays of the same intensity caused no visible effects on form, rate of division or process of conjugation.

The author exposed the sperm of the toad to heat at 50° and 65° C. for from 15 to 20 minutes. This exposure destroyed the fertilizing power of most of the spermatozoa, but the few eggs fertilized by such sperm developed normally. Sperm exposed for from 15 to 20 minutes to the following solutions: 1/40 per cent. formol, 12.5 per cent. ethyl alcohol, 1 per cent. NaCl, 1/32 per cent. HCl and 1/32 per cent. KOH, had the power of fertilizing toad eggs. Practically all of the resulting larvas that have been preserved appear normal at the end of one month after fertilization of the eggs. Sperm exposed to stronger solutions of the same substance for 15 to 20 minutes seems to lose power of fertilizing. No abnormal larvas have developed from the few eggs thus fertilized.

On the Absorption of Toxins by the Nerves: Cyrus W. Field.

In a large number of animals into which both tetanus and diphtheria toxin had been injected, Field found that the toxin was present in the peripheral nerves leading from the inoculated area; and by the use of the right dose, and at a certain time, free toxin could be demonstrated in the cord, although the other tissues of the body, including the blood, liver, spleen and kidneys, contained no free toxin.

Not only is this true for diphtheria and tetanus, but it is likewise true for the toxin produced from *B. botulinus* and also for colloidal ferric hydrate. In the case of colloidal ferric hydrate, by removing the nerves and cord, and subjecting them to treatment with a solution of hydrogen sulphide, Field was able to detect the presence of iron. By using small doses he was able to show the presence of these colloids in the nerves near the points of injection and in the spinal cord, but of none whatever in the other tissues, except at the points of inoculation.

The author concluded that tetanus toxin does not travel by way of the axis cylinder because of any specific attraction of the nerve tissue for this toxin, but it passes up because the lymphatic flow of the nerve is progressing constantly from the periphery to the center. For this reason the toxin, when injected subcutaneously or intramuscularly, is taken up by the nerves and passes to the cord; and the first symptom to develop is the local tetanus because the local cells are the first that come in contact with the toxin.

It is a well-known fact that in giving diphtheria or tetanus toxin intravenously a much greater dose is required to cause death than when either is injected subcutaneously or intramuscularly. The reasons for this are first, that the toxin injected into the blood may be combined with some of the constituents of the blood and therefore rendered inactive; second, that by injection into the blood the toxin is diluted to a very great extent, whereas when injected subcutaneously, a portion passes into the lymphatics of the nerves and is not mixed with the general body fluids, before it reaches the central nervous system.

The author's general conclusion was that tetanus does not travel up a nerve by reason of any specific attraction of nervous tissue, but because the lymphatic flow in a nerve is from the periphery toward the center.

On the Formation of a Specific Precipitin in Rabbits after Inoculation with Colloidal Platinum and Colloidal Silver: Cyrus W. Field.

Some time ago in testing the precipitating

effect of rabbit serum on various positive and negative colloids, Field found that such serum precipitated colloidal platinum and colloidal silver to a fair degree. Serum from one rabbit precipitated colloidal platinum completely at 1–100, slightly at 1–200 and not at all at 1–500. This serum precipitated colloidal silver completely at 1–10, partially at 1–100 and not at all at 1–250. After receiving three injections of colloidal platinum in three weeks this rabbit's serum then precipitated colloidal platinum completely at 1–1,000, slightly at 1–1,250 and not at all at 1–1,500, whereas it precipitated colloidal silver completely at 1–100, slightly at 1–250 and not at all at 1–500.

Serum from another rabbit originally precipitated colloidal platinum completely at 1–50, partially at 1–100 and not at all at 1–250. The same figures held good for colloidal silver. After three injections of colloidal silver during three weeks, this rabbit's serum precipitated the colloidal silver completely at 1–500, partially at 1–1,000, and not at all at 1–1,250, whereas colloidal platinum was completely precipitated at 1–200, partially at 1–500 and not at all at 1–1,000.

In other words the precipitating power of the serum of the first rabbit, after it received three injections of the colloidal platinum, had increased from 1–100 to 1–1,000 (= *ten times*), whereas for the colloidal silver there was only a very slight increase. Serum from the second rabbit, which received colloidal silver, increased its precipitating power from 1–100 to 1–500, whereas for the colloidal platinum, from 1–100 to 1–250. In both these rabbits there was then an increase in the precipitating power of the serum after injection of these colloidal metals, and it would seem that they increased more for the metal injected than for the other.

Remote Results of Transplantations of Blood Vessels: Alexis Carrel.

The results of arterio-arterial, veno-venous and arterio-venous anastomoses have remained excellent for many months. No stenoses or aneurisms have been observed on the arterial anastomoses even six to seven months after operation. No stenosis occurred after venous anastomosis: a cat, in which an Eck fistula was made eighteen months ago by Carrel and Guthrie, is still in good health. The same is true of an arterio-venous anastomosis: the jugular vein and the carotid artery of a dog were anastomosed by Carrel and Guthrie twenty-two months ago, and now strong thrills and pulsations can easily be detected by palpation of the jugular vein. The modifications of the vascular walls are produced mainly by the changes of blood pressure. No great change occurs if the blood pressure of the transplanted vessel be not modified. Segments of carotid, aorta or vena cava of one animal, transplanted in the carotid, aorta or vena cava of another animal of the same size and species, do not undergo any important anatomical modification. If blood pressure is diminished, the wall of the transplanted vessel becomes thinner. Six months after the operation, it was found that the wall of the carotid transplanted in the external jugular vein was thinner than the normal one. If blood pressure is increased, hypertrophy of the wall ensues. A segment of external jugular vein interposed between the cut ends of the carotid artery was a little dilated and its wall was as thick as the arterial wall, eight months after the operation. In other cases, there was no dilation of the lumen of the vessels. As a rule when a vein is anastomosed uniterminally to an artery, its lumen is found to be dilated, six or seven months after the operation. Nevertheless, after one year the lumen may progressively diminish in size, as was seen in a dog operated upon twenty-two months ago.

It may be concluded that transplanted blood vessels adapt themselves to the pressure by thinning or thickening their walls.

The Dependence of Gastric Secretion upon the Internal Secretion of the Salivary Glands: John C. Hemmeter. (Communicated by S. J. Meltzer.)

The relations of the gastric secretion to the salivary glands are illustrated by the following clinical and experimental observations:

1. In four cases of Mikulicz's disease, with

normal conditions of the blood, the stomach was found to secrete no gastric juice during the course of the disease. Mikulicz's disease consists of a benign chronic swelling of all the salivary and lacrimal glands.

2. In dogs with accessory stomachs (Pawlow) the removal of all the salivary glands abolishes permanently all gastric secretion.

3. The gastric secretion is not started in such dogs by feeding them with food masticated and well insalivated by other normal dogs.

4. The abolished gastric secretion is temporarily resumed by peritoneal or intravenous injections of extracts made of salivary glands of normal dogs.

5. This temporary resumption takes place even if the stomach be completely isolated from the central nervous system.

These observations justify the conclusion that normal gastric secretion depends upon the internal secretion of the salivary glands.

The Influence of Diuresis upon the Toxic Dose of Magnesium Salts: S. J. Meltzer.

A dose of 2 grams of magnesium sulphate per kilo is absolutely fatal for the rabbit; the animal dies of respiratory paralysis in less than an hour. All the animals recovered from the effects of such a dose, however, if an intramuscular injection of diuretin was given soon after the subcutaneous injection of the magnesium salt. Diuretin is theobromin and acts as a diuretic. The deeply narcotized animals usually urinate about fifteen or twenty minutes after its injection; by that time, at least, the bladder can be felt to be full. The largest dose that should be given is about 0.1 gram. In larger doses diuretin itself is liable to become toxic.

When the dose of the magnesium sulphate exceeded 2 grams per kilo, the injection of diuretin alone could not save the animals. But if, in addition to the diuretin, an intravenous infusion of 0.9 per cent. solution of sodium chloride was instituted, animals recovered from doses of magnesium sulphate amounting to as much as 2.25 grams per kilo. When still larger doses of the magnesium salt were given, the animals usually died of respiratory paralysis in less than fifteen minutes and before any diuresis could have been effected. Animals recovered from doses as large as 2.5 grams per kilo, if, in addition to the diuretin injection and the venous transfusion, artificial respiration was early resorted to. For doses larger than 2.5 grams per kilo all three measures together usually proved of no avail; with this dose the early death of the animal is usually due greatly to paralysis of the heart.

The Toxicity of Magnesium Nitrate when given by Mouth: S. J. Meltzer.

It is a daily experience that large doses of magnesium sulphate can be taken by mouth without any other than a purgative effect. Meltzer has given to rabbits, by mouth, 7 grams or more of magnesium sulphate (in molecular solution) per kilo, without any unfavorable effects. The same applies also to magnesium chloride and various other magnesium salts. Meltzer has, however, discovered that magnesium *nitrate,* when given *by mouth,* is capable of producing a toxic effect like that of magnesium sulphate when introduced subcutaneously.

When a dose of 6 grams of magnesium *nitrate* per kilo (in molecular solution) is given by mouth to a rabbit, the animal soon becomes paralyzed and narcotized, and dies in from thirty to forty minutes of respiratory paralysis. Fifteen or twenty minutes after the administration, the appearance as well as behavior of the animal is exactly like that of one which received magnesium sulphate subcutaneously (2 grams per kilo). A dose betweeen 4 and 5 grams per kilo causes in general the same symptoms, but in a gradual way; the animal dies after five or six hours. A dose of between 3 and 4 grams causes no serious effects, but for six or eight hours after its administration the animal remains in a soporous state; it sits in one place with eyes closed and head drooping; a loud noise wakes it up and it attempts to move about or to eat, but in a few minutes it falls asleep again.

This toxicity of the magnesium nitrate is apparently due to its greater absorption from

the gastro-intestinal canal. It is certainly not due to diminished elimination through the kidneys; on the contrary, it acts in some degree as a diuretic, and, when given by subcutaneous injection, the animal withstands a somewhat greater proportionate dose of the nitrate than of the sulphate or chloride, probably because the nitrate increases somewhat the diuresis.

Meltzer believes that the effects observed can not be attributed to the nitrate radical (NO_3). He studied the toxic effects of sodium nitrate after administration by mouth and compared the resultant symptoms with those seen after administration of magnesium nitrate; the contrast was sharp. Even with a dose of 12 grams of the sodium nitrate per kilo there is never such anesthesia or paralysis as that caused by the magnesium salts; on the contrary, the animal is all excitement and restlessness. Besides, the late death of the animal after administration of sodium nitrate is due to circulatory disturbances, whereas after poisoning with magnesium salts the animal dies of respiratory paralysis.

On the Promoting Influence of Heated Tumor Emulsions on Tumor Growth: Simon Flexner and J. W. Jobling.

The authors gave the results of a study of an effect on the growth of a transplantable sarcoma of the rat which is produced by inoculation of rats with an emulsion of the tumor cells, previously heated for half an hour to 56° C. This emulsion was injected into the peritoneal cavity and the fragments of living tumor were introduced beneath the skin. The promoting effect on the growth of the tumor fragments to be described became evident in several sets of experiments in which the tumor emulsion (*unheated*), blood serum, bouillon, salt and Ringer solutions were injected in the same manner, with which substances this promoting effect was not obtained. When the inoculation of the fragment of the tumor was made twenty-four hours after the injection of the unheated emulsion, no difference was noted between the control rats and the rats injected with the enumerated materials, including the *heated* emulsion. But when the fragments were inoculated ten or more days (up to thirty days) later, then the number of tumors which developed in the rats receiving the *heated* emulsion tended to exceed the controls and the other series mentioned; they grew with greater rapidity so as to reach double the size of the controls or even a still greater size, and showed a far smaller percentage of recoveries (retrogressions). This promoting influence was exerted on the tenth day after inoculation, and various indications suggested that it was less effective at the expiration of thirty days. On the other hand, it appeared that when the injections of heated emulsion were repeated once or twice at ten-day intervals, the conditions of the animal favoring the growth and persistence of the tumors were maintained and possibly were even still further increased.

On the Chemical Inactivation and Regeneration of Complement: Hideyo Noguchi.

It was found that all acids and alkalies are able to inactivate complements when used in sufficient concentrations. With monobasic acids it takes about 1 c.c. of $n/40$ solution to inactivate 1 c.c. of active serum. About 1 c.c. of $n/50$ solution of the acid is, as a rule, neutralized by the inherent alkalinity of the serum.

With alkalies 0.3 c.c. (ammonium hydrate 0.8 c.c.) is sufficient for inactivation. The acids and alkalies are, when used without serum, hemolytic in the quantities stated. But when mixed with the serum they—serum and chemicals—lose their activity mutually.

Alkaline salts of strong acids are not anti-complementary unless a certain limit of concentration is exceeded. Sodium carbonate is anti-complementary in a relative, but not in an absolute sense. All other salts employed are strongly anti-complementary, the magnesium salts being the least inhibiting. Calcium and barium salts of strong acids are absolute anti-complements, while the carbonates of these elements may or may not be active upon complements.

Complements which are inactivated by acids can be reactivated by neutralizing the acids with alkalies, and *vice versa*. The action of

various acids, alkalies and salts upon complements renders the complement-deviation phenomenon for forensic purposes less safe, because the materials are often impure in practical cases.

Various soluble salts of oleic acid are accelerators of the complementary action of serum.

A Study of the Influence of Lecithin on Growth: A. J. GOLDFARB.

The author's experiments included three series of over 1,200 tadpoles. In each series the lecithin varied in strength from 1/150 per cent. to 2 per cent. (the toxic concentration). In one series (1) the tadpoles were not fed, in another (2) they were given minced worm, in the third (3) they were given a liberal supply of plant débris.

The tadpoles that were kept in lecithin solutions did not show any greater increment in weight or size than the controls of the same series. There was a marked difference, however, in both the size and weight of tadpoles of one series compared with the tadpoles in the corresponding solution of another series, due to the kind (and presumably the amount) of food given. Individuals of series 1 were smallest and weighed least; those of series 3 weighed from 3 to 6 times as much and were twice as broad as the tadpoles in the same strength of solution in series 2.

Young kittens (over 50 in number) were treated as follows:

Series 1. Lecithin was injected subcutaneously daily in doses of from 0.0006 to 0.004 gram. Control animals received subcutaneously equal volumes of physiological salt solution. The increase in weight was somewhat greater in the kittens that received the lecithin.

Series 2. Lecithin was injected subcutaneously in doses of from 0.01 to 0.32 gram daily. The kittens that received the lecithin gained, in some cases, as much as 7 per cent. over the control animals.

Series 3. Lecithin was fed daily in amounts of from 0.01 to 0.32 gram. With very few exceptions, these kittens weighed from 2 per cent. to 12 per cent. more than the controls.

The best results were obtained in the feeding experiments, with doses of from 0.04 to 0.16 gram daily; yet under these conditions, the actual difference in weight between the kittens fed with lecithin and those not so fed was small, amounting on an average to about 7 per cent. Whether the same quantity of any other fatty or simple nutrient compound would result in an equal increment has not yet been determined, but will be investigated with other matters bearing upon the interpretation of the results recorded above.

Comparative Data for the Elementary Composition and the Heat of Combustion of Collagen and Gelatin: CHARLOTTE R. MANNING and WILLIAM J. GIES.

Comparative elementary analyses, as well as determinations of the heat of combustion, of many samples of connective tissue collagen and gelatin, have indicated that there is a closer agreement between the mother substance and its derivative, on these two planes of comparison, than the prevalent idea of their chemical relationship would indicate. The following sample data show this quite clearly:

	C Per Cent.	H Per Cent.	N Per Cent.	Heat of combustion. Cal.
Tendocollagen[2] ..	48.85	8.01	18.02	5,387
Tendogelatin ...	48.28	7.84	17.56	5,350

The differences between the above figures for nitrogen and hydrogen contents harmonize with the observation by Emmett and Gies that nitrogen is eliminated as ammonia when collagen is converted into gelatin by treatment with hot water, and also strengthen their conclusion that gelatin is not a simple hydrate of collagen.

On the Fate of Elastose after its Subcutaneous or Intraperitoneal Injection: a Preliminary Inquiry into the Origin and

[2] Each of these products was desiccated (before analysis) to constant weight by the Benedict-Manning process *in vacuo*. See the *American Journal of Physiology*, 1905, XIII., p. 309.

Nature of Bence Jones's Protein: REUBEN OTTENBERG and WILLIAM J. GIES.

Bence Jones's protein and crude elastose not only have several proteose properties in common, but unlike the ordinary proteoses, each is precipitated from its aqueous solution when the latter is gently warmed. Bence Jones's protein occurs in the urine of patients suffering from sarcoma of bone marrow or from osteomalacia. Bone contains considerable elastin-like material (osseoalbumoid). The possibility that Bence Jones's protein may be a derivative of osseoalbumoid, and the great desirability of making our knowledge of this elusive protein more definite, led the authors to undertake a study of a preliminary phase of the work that will be necessary to determine the points at issue.

They sought first to ascertain whether crude elastose, when injected subcutaneously or intraperitoneally, is eliminated in the urine and whether it can be detected there by the heat-precipitation test. When thus introduced in dogs, crude elastose, obtained by peptolysis of ligament elastin prepared by Richards and Gies's method, not only promptly appears in the urine, but may be identified in it by the heat-precipitation test. This observation makes it clear that if elastose is formed in bone or in any other tissue by any pathological process, the elastose thus produced may pass into the urine without material alteration of the characteristic property referred to.

Before proceeding further in this connection, the authors intend to prepare osseoalbumoid (bone elastin?) in sufficient quantity to permit of a determination of the nature of its proteoses and their fate when injected into animals.

WILLIAM J. GIES,
Secretary

THE AMERICAN PHILOSOPHICAL SOCIETY

A STATED meeting of the society was held on Friday, October 4. The following papers were read:

DR. EDGAR F. SMITH: "New Results in Electrolysis."

PROFESSOR SIMON NEWCOMB: "A Study of Correlations among Terrestrial Temperatures, as indicating Fluctuations in the Sun's Thermal Radiation."

R. H. MATHEWS, L.S.: "Language of the Burdhawal Tribe in Gippsland, Victoria."

DISCUSSION AND CORRESPONDENCE

SMELTER SMOKE

IN an article recently published in the *Journal of the American Chemical Society* (July, 1907) on gases *vs.* solids, an investigation of the injurious ingredients of smelter smoke, by Professor W. Clarence Ebaugh, the results of the investigation are contrary to previous experiments along this line as well as to the experience of the writer, and it appears to him that the conclusions are based on misleading and inadequate data.

The writer is very much averse to criticizing the work of a brother scientist, but since the results of this work, if uncontradicted, will undoubtedly be used in many cases between smelters and injured parties, it would only seem proper to point out the fallacy of the arguments. Not to be misunderstood in the beginning, the writer wishes to explain that he is firmly of the opinion that the solid emanations which arise from a smelter (including perhaps, soluble copper, arsenic and lead compounds) are injurious to vegetation in so far as they reach it, but that such emanations reach as far as sulphur dioxide or have so injurious an action appears to be decidedly doubtful and has certainly not been proven in the paper published by Professor Ebaugh.

On page 953, of his article, Professor Ebaugh says:

> In the first place, the injury (in the Salt Lake Valley) does not occur simultaneously over a large area; on the contrary, it seems to be restricted in its range. Secondly, it is rarely found that a number of crops grown successively in a given locality show the effect of smelter smoke, etc.

The above assertions are, of course, only the personal opinion of Professor Ebaugh but in the main they are diametrically opposed to the experience of the writer who has examined smelter injury at Redding, Cal., Ducktown, Tenn., and at Anaconda, Mont. In every case examined by the writer the injury *did* occur

simultaneously over a large area, if by a large area is understood the country around the smelter for from five to twenty miles, depending upon the direction of the prevailing winds. Again, it has been the writer's experience that successive crops in a given locality *did* show the effect of smelter fumes. This is especially shown in the vicinity of Ducktown, Tenn., where the same deciduous trees surrounding the smelter are injured each year until they finally succumb.

On page 953, Professor Ebaugh also gives a table showing the amount of sulphur dioxide per million parts of air found in the atmosphere in the vicinity of the smelters in the Salt Lake Valley and in his discussion of this table ends it by saying, "Nevertheless, the very small amount of sulphur dioxide found is certainly surprising." The force of this last sentence is to lead one who knows nothing about the matter to believe that such amounts as were found are insignificant and would not be injurious. Let us look at the figures of 524 cases examined. In 213 cases, or 40.66 per cent., the amount of sulphur dioxide is one part per million, or more, of the air. By actual experiments of careful workers[1] it has been shown that plants are injured by repeated treatments of one part sulphur dioxide per million parts of air. Again, as explained by Professor Ebaugh himself, such results as were obtained in the above table are practically valueless since the concentration of sulphur dioxide might be, say, one to 1,000, for a short while and hence do serious injury, while if this amount were spread over an average time of twelve to twenty-four hours, it would amount to a very little.

On page 954, Professor Ebaugh with the following data: (*a*) size of stacks, (*b*) sulphur dioxide content of stack gases, (*c*) width and thickness of the visible smoke column at a given time and place, calculates roughly what the sulphur dioxide content of the atmosphere would amount to. The writer is unable to see with the above data how such a calculation could be made with even rough accuracy. Even if such calculation could be made, however, the results are valueless in judging what the sulphur dioxide content of the atmosphere might be at varying distances from the smelter, since on some days and when the fumes float in certain directions, as up ravines, etc., the sulphur dioxide content of the atmosphere of these ravines might be ten times that of a point on the level country much nearer the smelter and yet in both cases the three factors above be practically the same.

On page 956, Professor Ebaugh says:

> Concerning paragraph 5, it should be noted that in the open country one seldom finds sulphur dioxide acting for a long-continued time in one place, etc.

The writer has in some of the regions which he has visited seen the smelter smoke act on the same side of a mountain range and on the same plants for days at a time and has been told by competent parties residing in the country, that this action in the same direction often continued for weeks.

On pages 957 and 958, Professor Ebaugh gives his data in regard to the injurious effect of sulphur dioxide on foliage. Note that in every case but one (where one part sulphur dioxide to 50,000 parts of air were used and twelve fumigations on sugar beets) injurious results were noted. Even with the above data, which at the best were not conclusive, because more fumigations should have been used on the sugar beets not injured by twelve fumigations, Professor Ebaugh draws the following conclusion on page 969:

> By no means is sulphur dioxide to be considered as harmless, especially in an enclosed space and in a moist climate, but we are forced by the weight of the evidence to the conclusion stated in the introduction, viz., that heretofore undue emphasis has been laid upon the injurious effect of sulphur dioxide upon growing plants, and that the harmful action of the solid emanations from the smelters—the so-called flue dust—has been seriously underestimated.

The writer is absolutely unable to see that the weight of evidence points in the direction indicated by the above quotation. Judging by the results on fumigation with sulphur dioxide carried out by him in conjunction with the

[1] See Haselhoff and Lindau's work on "Injury to Vegetation by Fumes."

results obtained by using the solid emanations on plants, we can at least say, "not proven."

On pages 962, 963, 964, 965, 966 and 967, are given tables showing: (1) the chemical composition of the flue dust; (2) the lead, copper and arsenic content of hay around a smelter; (3) the lead, copper and arsenic content of the dust from rafters in barns around the smelter; (4) the action of mixtures of flue dust and soil on sugar beets; (5) the action of aqueous solution of flue dust on sugar beets.

His results on the composition of the samples of hay around the smelter and the composition of the dust from rafters in barns, etc., are of only limited value since he does not give the distances from the smelter at which each of these samples was taken. His results on the effect of the mixture of flue dust and soil, as well as his results with the water solution on sugar beets, are practically valueless, since the actual amount of flue dust added to the leaves and its relative weight as compared with the leaves are not given. In other words, it is impossible from the data given to judge how much of the flue dust (including arsenic, copper, etc.) was added to each leaf. Without the above data it is impossible to tell whether the amount of lead, copper and arsenic added by dusting or spraying corresponds to the amount of these substances actually found in the hay around the smelter, or not. Here again the experiments are incomplete and here again one may say, "not proven."

On the whole, then, it is at once evident that the series of experiments carried out by Professor Ebaugh do show that the solid emanations from a smelter in certain strengths are extremely toxic to plants. They do not show, however, that such solid emanations are injurious when added in the strengths which may settle on the leaves around a smelter.

Again, all the fumigation experiments with sulphur dioxide, carried out in the above article, except one, show that the leaves were injured and many of the experiments (such as they were) on treating plants with the diluted solid emanations show injury, yet with the proofs as evenly balanced as they are, the author of the article claims that "we are forced by the weight of evidence to the conclusion stated in the introduction, *viz,* that heretofore undue emphasis has been laid upon the injurious effect of sulphur dioxide upon growing plants, and that the harmful action of the solid emanations from the smelters—the so-called flue dust—has been seriously underestimated."

Finally, the writer would draw attention to the country in the vicinity of Ducktown, Tenn. Here, well-marked injury to forests can be noted at a distance of about twenty-five miles from the smelter, yet solid emanations which might have any injurious effect on foliage consist almost entirely of copper compounds since arsenic is not present in appreciable amounts, if at all. It is well known that grape foliage, apple foliage and foliage of certain other plants can be treated with about 1 part of copper sulphate, to 400 to 500 parts of water, without injury. It is hardly possible to believe that the copper compound from the smelter could be carried in more than a trace (if even to this extent) for a distance of twenty-five miles. It is less possible to believe that they could be carried in such quantities as to amount to 1/400 of the rain that might fall upon them, yet here we have a case of decided injury at a distance of twenty-five miles. Add to the above reasoning the fact that the sulphur trioxide content of the injured foliage can be shown to be greater than that of the uninjured foliage beyond the range of damage and that the leaves of the trees have the nearly characteristic appearance of sulphur dioxide injury, and it is impossible to reach any conclusion except that the trees were injured by sulphur dioxide.

While it is possible, in fact extremely probable, that in actual practise solid emanations in the vicinity of a smelter do injure vegetation to a greater or less extent, this fact has not been proven by the above experiments.

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THE ARTIFICIAL PRODUCTION OF MUTANTS—A SUGGESTION

IN SCIENCE for September 13, 1907, Professor Spalding calls attention to the importance of Dr. MacDougal's discovery that new modifications can be made in plants by injecting various substances into the capsules of plants before the ovules are fertilized. I wish to suggest the desirability of a study of these artificially produced plant forms with a view to ascertaining whether the production of the new forms is coincident with a change in the number of chromosomes. It has recently been shown that deVries's *Enothera gigas* has twice as many chromosomes as the parent species, and a year ago I suggested that perhaps all of deVries's mutants may differ in a similar way from *Enothera lamarkiana*.

It is a very interesting question, should we find these mutations due to increase or decrease in the number of chromosomes, just what importance these mutations have in evolutionary progress. It certainly seems to me that we are a little hasty in ascribing to them fundamental importance. So far as we have any evidence on the subject, it seems to me that these mutants must be looked upon as aberrant forms, and in a certain sense degenerates. That all evolutionary progress depends upon these so-called mutations seems to me to be entirely out of the question, assuming, of course, a change in the number of chromosomes to be at the basis of mutation in the deVriesian sense. Too many distantly related species have the same number of chromosomes.

W. J. SPILLMAN
U. S. DEPARTMENT OF AGRICULTURE

AN ALLEGED DIPHTHERITIC ANTITOXIN

TO THE EDITOR OF SCIENCE: Notwithstanding previous denials on my part in the local papers and before the Columbus Academy of Medicine letters are being sent out by a local firm connecting my name with an alleged discovery of a new diphtheritic antitoxin.

I wish to state that such statements are absolutely unwarranted, as I have made no tests or investigations of any character concerning the preparation, nor have any such tests been made in my laboratories.

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SPECIAL ARTICLES

HEART ROT OF SASSAFRAS SASSAFRAS CAUSED BY FOMES RIBIS[1]

So far as known, the tree *Sassafras sassafras* has very few enemies among the fungi, and is commonly very free from their attacks. It has, however, been found by the writer to be quite seriously affected in Missouri by one of the Polypori. The fungus which has thus been found attacking the *Sassafras* has been submitted to Professor Chas. H. Peck, and was pronounced to be *Fomes Ribis* (Schum.) Gillet. This fungus commonly occurs only upon the stems and roots of various species of small shrubby plants. It has been found occurring on rose bushes, currant bushes, and on living stems of *Symphoricarpus occidentalis*. The occurrence of this fungus upon any of the large trees seems to be anomalous, yet in a limited district it has been found thus occurring very plentifully and destructively.

Fomes Ribis occurs quite generally throughout European countries, but it does not seem to be at all common in America. It has been reported from as widely separated points as Kansas, Missouri, New Jersey and New York.

A careful examination showed that the sporophores of this fungus were always located at points where the heartwood of the tree had been exposed either by the breaking of branches or the splitting of the main trunk. No exception to this rule was observed, although the search was quite careful throughout the locality where the fungus was found. The smallest tree which was found to be affected was about five inches in diameter, and had abundant heartwood in the stem and older branches. The *Sassafras* has but few annual rings of sapwood, and thus reaches an age at which it has heartwood very early. It is believed that in this disease it is absolutely

[1] Published with permission of the Secretary of Agriculture.

necessary for the tree to attain the age at which it has heartwood before it may become infected by this fungus; that is, it seems to be necessary that the tree shall have heartwood and that the heartwood must be exposed by some injury before *Fomes Ribis* is able to obtain an entrance to its trunk. While there is a bare possibility of exceptions to this rule, no such were found. Practically every tree, in which wounds were found by which the heartwood was exposed, was infected and bore one or more sporophores of the fungus. *Fomes Ribis* enters the trunk of the tree apparently in the same manner as do most of the so-called "wound parasites." It obtains a foothold in one of these injuries and gradually progresses into the heartwood of the stem; once entrance has been obtained to this, the rot gradually extends upward, downward and sidewise from its first entrance into the trunk until the tree finally dies or is broken over by the wind. When the heartwood has become completely affected through its entire thickness, the adjacent rings of the sapwood seem to prematurely assume the characters of heartwood, and the rot finally extends into them also; so that in extreme cases the sapwood is found to be even thinner than it normally is. Cases were found where this process apparently extended until the tree was killed outright. A number of other cases were also found in which but a single ring of the sapwood still remained alive.

The heartwood of *Sassafras* is normally of a rather dark brown color, but when attacked by this fungus it assumes a slightly redder and lighter color. This color of the rotted wood is undoubtedly due to the fact that the mycelium of this fungus is itself of a ferruginous brown color, and thus helps to give a brown coloration to the tissues within which it is located. The wood is very porous, and the fungus fills the large vessels and tracheids with its brown mycelium, forming tangled masses which completely fill their cavities. Between the healthy and the rotted wood is a narrow black zone. Microchemical tests indicate that the fungus does not exert a very active delignification upon the cell walls, but that the tendency seems to be for a more or less complete local solution of the entire cell wall. The rotted wood seems to retain much of its original appearance, yet has been very decidedly weakened by the action of the fungus in dissolving the middle lamellæ from between many of the cells, so that they adhere to each other but slightly.

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NOTE ON THE MOVEMENT OF MOISTURE IN SOILS

IN teaching physics it is particularly important, whenever practical, to show how phenomena observed in nature are explained by facts discovered in the laboratory. For this reason it is hoped that the following, though containing nothing new in physics, may be of interest to those who have the honor of instructing others.

It is known that evaporation, condensation and surface tension, all play important roles in the movement of moisture in soils. The U. S. Department of Agriculture has conducted a number of investigations on these subjects, and has reached some valuable conclusions. The effects, however, due to changes in surface tension, produced by changes in temperature, have not been considered in detail, nor do I recall having seen them mentioned anywhere else.

It has long been known that the surface tension of a liquid increases as its temperature is lowered. In the case of water at least this relation continues at the same rate to and below the ordinary freezing point, provided the liquid condition is maintained; and therefore any change in the temperature of the soil, such as takes place to a greater or less extent every day and night, must produce a corresponding movement of its moisture towards the colder parts, where the surface tension is greatest. Besides, evaporation, which is most rapid where the temperature is highest, and condensation, which is greatest on the coldest surfaces, produce moisture movements in the same direction as those made by temperature changes in surface tension, so that the several causes work together. But, owing to a variety

of influencing conditions, their relative importance in producing the common effect is not easy to determine.

Evidently, since the temperature is nearly always lower at night than during the daytime, the upper layer of the soil thus cooled is usually damper in the early morning than in the afternoon; and whenever the temperature falls very greatly, the corresponding large increase in the tension and in the condensation at the cold surface will take much moisture from the warmer soil beneath. It is largely, if not wholly, this that leads to wet soils so often seen on cold mornings when there has been no rain, and to the surprising depth of mud that frequently follows a thaw. It accounts too for the considerable supply of moisture from the deeper soil in the production of ice columns—spewing of the ground.

This temperature effect on surface tension, on condensation and on evaporation also greatly conserves that moisture already in the earth and keeps it in motion. That is, the moisture is brought to the surface in greatest abundance only when the temperature there is low and therefore the rate of evaporation into the air small; and whenever the surface temperature is increased, leading to a higher rate of evaporation into the air, the moisture is drawn away to the colder portions of the soil beneath, where it is protected from the winds by the top layers which it has just left.

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BOTANICAL NOTES

A NEW EDITION OF ENGLER'S SYLLABUS

THE fifth edition of Engler's "Syllabus der Pflanzenfamilien" (Borntraeger, Berlin) which appeared during the present year, differs very little from the fourth (1904). A few slight changes are made here and there, but the book is essentially unchanged. Yet it has been reprinted from beginning to end, illustrating afresh the fact that in book publishing the Germans do things better than we. Had this book been published in this country the first edition would have been electrotyped, and it is safe to say that this fact would have made it impossible for us to have had four subsequent editions in the short time which has elapsed since the appearance of the first. The electrotyping of a scientific book ought not to be permitted, for it always means that the publisher proposes to keep it in essentially its present form for as long a time as possible. Why should not American botanists insist that their publishers shall not electrotype their books, and that the editions be of a limited number of copies? We ought not to be tied to our dead and disowned ideas merely because our publishers prefer to embalm them by electrotyping.

Another suggestion which comes to one who examines this book is that the term "Thallophyta" is passing. It has long stood as an omnibus term to cover many different groups of plants. In the third edition (1903) the term was abandoned, and in its place appeared eleven coordinate terms, which were reduced to ten in the fourth and fifth editions. One looks in vain for this time-honored name for the lower plants. It has apparently gone to the limbo to which have been banished "cryptogam" and "phenogam." The Vegetable Kingdom is now divided into twelve grand divisions or phyla, namely; *Phytosarcodina, Schizophyta, Flagellata, Dinoflagellata, Zygophyceae, Chlorophyceae, Charales, Phaeophyceae, Rhodophyceae, Eumycetes* (all of which formerly were lumped together as "Thallophyta"), *Embryophyta asiphonogama* (*Bryophyta* and *Pteridophyta*), and *Embryophyta siphonogama* (*Spermatophyta*). And yet we shall doubtless have the text-books speaking about "Thallophyta" for years to come, as though the group had not been long since abandoned.

A NEW LABORATORY MANUAL

AN interesting and no doubt useful laboratory manual is Müller's "Mikroskopisches und Physiologisches Praktikum der Botanik für Lehrer" (Teubner, Leipzig), a little book of 240 pages and 235 text illustrations. Twenty pages are given to the microscope and micro-

scopical technique, and this is followed by 27 pages on the cell, 147 on the structure of phanerogams, and 44 on experimental plant physiology. The topics are well chosen, the directions clear and explicit, while the numerous illustrations help to make the text still more easily understood.

MORE AGRICULTURAL BOTANY

In preparing a book on "Forage and Fiber Crops in America" (Orange Judd Co.) for the farmer and the student of agriculture, Professor Hunt, of Cornell University, has at the same time rendered a valuable service to botany and the botanists. He has brought together many important structural and economic facts in which the general botanist is interested, but which have been difficult of access, because so widely scattered in botanical and agricultural books and periodicals. Here the botanist will find good, if rather popular, descriptions of the common grasses and other plants used for forage, and such fiber plants as cotton, flax, hemp, jute, ramie, etc. The scientific side of the discussions has been unusually well done, and the botanist is not constantly shocked, as he is too often in books of this kind, by anachronisms in nomenclature and spelling. The illustrations are well selected, and were put in to help the text, and not as pretty pictures to help sell the book. Every picture has its use as fully as every sentence in the text, which is more than can be said of many books, botanical as well as agricultural.

STUDIES IN PLANT CHEMISTRY

Under the title "Studies in Plant Chemistry, and Literary Papers" (Riverside Press) have been collected the papers and addresses of the late Mrs. Helen Abbott Michael. They are of interest to botanists as being among the first of their kind published in this country. They include such titles as "A Chemical Study of *Yucca angustifolia*" "Certain Chemical Constituents of Plants considered in Relation to their Morphology and Evolution," "Plant Analysis as an Applied Science," "The Chemical Basis of Plant Forms," "Comparative Chemistry of Higher and Lower Plants," etc. Of the author and her work Dr. Wiley, of Washington, says: "She was among the very first investigators in this country who began in a systematic way to study the relations of chemical composition to species of plants and to plant growth." And again, "The most important result of her investigations pointed out in a clear way the regular existence of certain classes of chemical bodies in certain species of plants."

Many botanists remember the author of these papers with pleasure as an attractive young woman (Miss Helen C. De S. Abbott) who twenty or more years ago used to be one of the most interested members of the American Association for the Advancement of Science. To a charming personality she added a deep and intelligent interest in the scientific work of the association, especially in chemistry and botany. In the appreciative biographical sketch by Nathan H. Dole, which fills the first hundred pages, we learn much of her life of helpfulness and usefulness, of her marriage, her travels, her scientific and philanthropic plans, and of her untimely death on the twenty-ninth of November, 1904. Her name deserves to be placed high in the short list of scientific women in America, and the botanists especially should remember her as one who wrought well and faithfully in her efforts to add to the upbuilding of a neglected department of their science.

Charles E. Bessey
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THE DENSITY OF THE ETHER[1]

1. The theory that an electric charge must possess the equivalent of inertia was clearly established by J. J. Thomson in the *Phil. Mag.* for April, 1881.

2. The discovery of masses smaller than atoms was made experimentally by J. J. Thomson, and communicated to Section A at Dover in 1889.

3. The thesis that the corpuscles so dis-

[1] Abstract of a paper read by Sir Oliver Lodge before Section A of the British Association for the Advancement of Science, Leicester, 1907.

covered consisted wholly of electric charges was sustained by many people, and was clinched by the experiments of Kaufmann in 1902.

4. The concentration of the ionic charge, required to give the observed corpuscular inertia, can be easily calculated; and consequently the size of the electric nucleus, or electron, is known.

5. The old perception that a magnetic field is kinetic has been developed by Kelvin, Heaviside, FitzGerald, Hicks and Larmor, most of whom have treated it as a flow along magnetic lines; though it may also, perhaps equally well, be regarded as a flow perpendicular to them and along the Poynting vector. The former doctrine is sustained by Larmor, as in accordance with the principle of least action, and with the absolutely stationary character of the ether as a whole; the latter view appears to be more consistent with the theories of J. J. Thomson.

6. A charge in motion is well known to be surrounded by a magnetic field; and the energy of the motion can be expressed in terms of the energy of this concomitant field—which again must be accounted as the kinetic energy of ethereous flow.

7. Putting these things together, and considering the ether as essentially incompressible —on the strength of the Cavendish electric experiment, the facts of gravitation, and the general idea of a connecting continuous medium—the author reckons that to deal with the ether dynamically it must be treated as having a density of the order 10^{12} grams per cubic centimeter.

8. The existence of transverse waves in the interior of a fluid can only be explained on gyrostatic principles, *i. e.*, by the kinetic or rotational elasticity of Lord Kelvin. And the internal circulatory speed of the intrinsic motion of such a fluid must be comparable with the velocity with which such waves are transmitted.

9. Putting these things together, it follows that the intrinsic or constitutional vortex energy of the ether must be of the order 10^{33} ergs per cubic centimeter.

Conclusion.—Thus every cubic millimeter of the universal ether of space must possess the equivalent of a thousand tons, and every part of it must be squirming internally with the velocity of light.

THE AMERICAN ELECTROCHEMICAL SOCIETY

THE twelfth general meeting of the American Electrochemical Society will be held in New York City on October 17, 18 and 19 (Thursday, Friday and Saturday of the third week of October).

The meeting will be opened by an evening session on Thursday, October 17. This session as well as the morning session on Friday, October 18, will be held at the Chemists' Club, 108 West 55th Street. The morning session of October 19 will be held in Havemeyer Hall, Columbia University. Headquarters for registering and information are at the Chemists' Club. Hotel headquarters are at the Hotel Cumberland, 54th Street and Broadway.

On Friday afternoon an excursion will be made to the laboratories of Mr. Thomas A. Edison. Mr. Edison will receive the visitors personally. A special car will be provided on the Delaware, Lackawanna & Western Railroad, the train leaving West 23d Street at 2:15. On the evening of Friday a subscription dinner will be held in Liederkranz Hall. Ladies are specially invited.

On Saturday afternoon an excursion will be made to the new Pennsylvania Railroad power plant at Long Island City, the New York Electrical Testing Laboratories and other points or places of interest to be announced at the meeting. On the evening of Saturday a smoker will be tendered to the American Electrochemical Society by the Chemists' Club.

During the meetings there will be an exhibition of some novelties of electrochemical products and apparatus at the Chemists' Club.

The program of papers is as follows:

Thursday Evening

8 P.M.—Reception and session at Chemists' Club.

8:40 P.M.—Illustrated lecture on "Diamond and

Moissanite: Natural, Artificial and Meteoric," by Dr. Geo. F. Kunz.

9:30 P.M.—Lecture on "Deflocculated Graphite," by Mr. E. G. Acheson, of Niagara Falls, with demonstrations and experiments.

Friday Morning Session

9 A.M.—At Chemists' Club.

"On the Electrothermic Reduction of Iron Ores," by Messrs. Albert E. Greene and Frank S. MacGregor.

"Discussion of the Electric-Furnace Experiments for the Production of Pig Iron at Sault Ste. Marie," by Dr. Joseph W. Richards.

"Electric-Furnace Experiments," by Dr. H. N. Potter.

"Discussion of Moissan's Experiments on the Boiling Points of the Metals," by Dr. O. P. Watts.

"The Electrometallurgy of Zinc," by M. Gustave Gin.

"A New Application of Chlorine in Metallurgy," by Mr. C. E. Baker.

"The Heat Conductivity of Carbon," by Mr. F. A. J. Fitzgerald.

"Granular Carbon Resistors," by Professor S. A. Tucker.

Saturday Morning Session

9 A.M.—At Columbia University.

"Physico-chemical Notes on the Aluminates of Soda," by Mr. P. B. Sadtler.

"Action of Ammonium Persulphates on Metals," by Mr. J. W. Turrentine.

"Note on the Use of the Capillary Electrometer for Alternating Voltages," by Mr. M. G. Floyd.

"Electroscopic Determination of Radium in some Tufa at Hot Springs, Arkansas," by Dr. Herman Schlundt.

"Electrolytic Separation of Silver and Copper," by Mr. H. W. Gillett.

"Electrolytic Determination of Minute Quantities of Copper," by Mr. E. E. Free.

"Electrolytic Reduction of Nitric Acid," by Dr. H. E. Patten and Robinson.

"Electrochemical Methods for the Qualitative and Quantitative Determination of Free Silicon in the Presence of Silica, Silicates, Oxides, Free Carbon and Carborundum," by Mr. W. R. Mott.

"On the Nature of Electrolytic Conductors," by Dr. L. Kahlenberg.

"The Electrolytic Theory of the Corrosion of Iron," by Dr. A. S. Cushman. (Lecture with demonstrations.)

Professor S. A. Tucker, Columbia University, is chairman of the New York Committee. Mr. Alois von Isakovics, Monticello, N. Y., is the local secretary.

SCIENTIFIC NOTES AND NEWS

A COMMITTEE has been formed in Germany, with the Prussian minister of state as chairman, to found an institution in honor of Dr. Robert Koch. It is intended that the institution shall be devoted to research into the means of checking the diffusion of tuberculosis and that it shall be a permanent memorial of the discovery of the tubercle bacillus by Professor Koch twenty-five years ago. Appeal is made for contributions sufficient to make the institution a tribute of gratitude to Koch, similar to those with which the name of Pasteur has been honored in France and that of Lister in England.

SIR ARCHIBALD GEIKIE, as president of the Geological Society of London, welcomed the members and delegates to the centenary celebrations on the morning of September 26, and in the afternoon gave an address on the state of geology at the time when the Geological Society was founded.

DEAN M. E. COOLEY, of the engineering department of the University of Michigan, has been appointed by the Interstate Commerce Commission to act as chairman of a committee which will meet in Washington to consider devices for the automatic control of trains.

AT the forty-fourth annual meeting of the American Veterinary Medical Association, recently held in Kansas City, Mo., Dr. W. H. Dalrymple, M.R.C.V.S., Louisiana State University, Baton Rouge, was elected president for the ensuing year.

PROFESSOR THEODORE W. RICHARDS, having returned from Germany, has been reappointed chairman of the division of chemistry in Harvard University. During his absence the chairmanship was held by Professor C. Loring Jackson.

PROFESSOR T. A. JAGGAR, of the Massachusetts Institute of Technology, has returned to

Boston from his trip to the Aleutian Islands, where he spent the summer studying the volcanic conditions.

Professor Eugene A. Smith, Teachers College, Columbia University, is at present in Japan. He is spending his sabbatical year in the orient, collecting mathematical books and manuscripts bearing on the history of mathematics.

Dr. George Grant MacCurdy, curator of the archeological collection of Peabody Museum, Yale University, has during the past vacation mapped out the state of Connecticut for a systematic archeological survey, bearing particularly on the traces of the Connecticut Indians.

Dr. C. L. Muralt, of the University of Michigan, has been granted a short leave of absence, in order that he may act as consulting engineer in the electrification of the Altberg tunnel, which is being constructed by the Austrian government.

Mr. Raymond E. Priestley, a student of University College, Bristol, has been appointed geologist of the expedition to the Antarctic under the command of Lieutenant Shackleton. The party sails from Liverpool in October, for New Zealand, to join the *Nimrod*.

Professor and Mrs. David P. Todd left Lima on September 28, for the United States, by way of the Isthmus of Panama. While in Lima Mrs. Todd gave an address before the Geographical Society, her subject being "The Ainus of Japan," among whom she resided for several weeks in 1896, while the *Coronet* Eclipse Expedition was stationed in Yezo.

Professor William Bateson, of Cambridge University, is giving, on October 3 and 31, and November 1, at the Brooklyn Institute of Arts and Sciences, three illustrated lectures, entitled "Demonstrations of Mendel's Principles of Heredity."

Inaugural exercises will be held on October 18 at 2 p.m. at Urbana, Ill., to celebrate the election of Dr. Wm. A. Noyes as professor of chemistry, head of the Department of Chemistry, and director of the Chemical Laboratory of the University of Illinois. The following program has been arranged:

Address: President Edmond J. James, Ph.D., LL.D.

"The Relation of Chemistry to Agriculture," by Professor H. A. Weber, Ph.D., professor of agricultural chemistry, Ohio State University.

"The Relation of Chemistry to the Industries," by Dr. William McMurtrie, Ph.D., consulting chemist, New York City.

"The Teaching of Chemistry in State Universities," by Professor George B. Frankfurter, Ph.D., dean of the School of Chemistry, University of Minnesota.

"The Contribution of Chemistry to Modern Life," by Professor William Albert Noyes, Ph.D., professor of chemistry and director of the chemical laboratory, University of Illinois.

At 8 o'clock in the evening an inaugural banquet will be provided, and on the following morning the Chemical Laboratories will be open to the public for inspection.

During the academic year 1907–08 Columbia University offers the following series of non-technical lectures descriptive of the achievements of science and modern scholarship. While the lectures are intended primarily for the officers, students and alumni of the university, they will also be open to the public. The lectures will be given in 309 Havemeyer Hall on Wednesday afternoons at 4:10 p.m.

Oct. 16—Mathematics, Professor Keyser.
23—Physics, Professor Nichols.
30—Chemistry, Professor Chandler.
Nov. 6—Astronomy, Professor Jacoby.
13—Geology, Professor Kemp.
20—Biology, Professor Wilson.
27—Physiology, Professor Lee.
Dec. 4—Botany, Professor Richards.
11—Zoology, Professor Crampton.
18—Anthropology, Professor Boas.
Jan. 8—Archeology, Professor Wheeler.
15—History, Professor Robinson.
22—Economics, Professor Seager.
Feb. 12—Politics, Professor Beard.
19—Jurisprudence, Professor Munroe Smith.
26—Sociology, Professor Giddings.
Mar. 4—Philosophy, President Butler.
11—Psychology, Professor Woodworth.
18—Metaphysics, Professor Woodbridge.
25—Ethics, Professor Dewey.
Apr. 1—Philology, Professor Jackson.
8—Literature, Professor Peck.

Foreign papers report that an institution for promoting science and scholarship has been founded in Rome, with headquarters at the Vatican Observatory under the direction of Father Hagen. The institution is to have offices in the different countries.

The late Josephine Naprstek has bequeathed 80,000 crowns to the Naprstek Bohemian Industrial Museum in Prague. The museum, which is to a large extent ethnographical in character, was established by Herr and Frau Naprstek.

An anonymous gift of $2,500 has been received for the investigation of cancer at the Harvard Medical School. This will be used under the advice of the Cancer Commission now administering the Caroline Brewer Croft Fund.

A Bulgarian Museum of Natural History was opened in Sofia at the beginning of this month.

We learn from the *Journal of the New York Botanical Garden* Mr. Oakes Ames, of North Easton, Mass., has presented his valuable collection of living orchids to the garden. This collection is the result of many years work. It contains many valuable plants, some of great rarity.

The Internaticnal Statistical Institute will hold its twelfth biennial session at Paris in 1909.

On the occasion of the seventy-eighth Congress of the German Men of Science and Physicians, held at Dresden from September 15 to 21, the city of Dresden appropriated for the meeting 20,000 Marks, 14,000 of which were spent for the entertainment of members. This has aroused objections from the public, and in the daily as well as the scientific press, the practise of public entertainment on such occasion has been criticized severely.

The International Congress of "Free Thinkers" was held from September 8 to 12, in Prague. The attendance consisted largely of scientific men and physicians. Honors were paid to the memory of Berthelot, the great chemist, formerly president of the French branch of the society.

The U. S. Civil Service Commission announces the postponement to November 6–7, 1907, of the examination scheduled for October 23–24, to fill the position of anatomist (male), at $1,600 per annum, in the Army Medical Museum. The commission further announces an examination on October 23, to fill vacancies as they may occur in the position of laboratory helper, at $600 per annum each, in the Bureau of Chemistry, Department of Agriculture, at Washington, and in other cities in which the department has established chemical laboratories. Vacancies in this position are constantly occurring. Chemical laboratory helpers will be required to render assistance in any work that does not require the training of a chemist. Their duties will be the cleaning of apparatus, the construction and repairing of apparatus, the care and storage of chemicals and apparatus, the preparation of stock solutions and of special reagents, and any other work in which they can save the time of chemists by performing labor that is essentially manual and does not require the training of a chemist, but is of such a nature that it can only be performed by one who has had training and experience in a chemical laboratory. Applicants must indicate in their applications that they have had actual experience as helpers in chemical laboratories. It is not desired that qualified chemists should apply for this examination, as the work will not be of an analytical character. Analysts are appointed from the examination for scientific assistant. Age limit eighteen years or over on the date of the examination.

Detailed statistics of the world's production of coal, by countries, are incorporated in an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," on the production of coal in 1906, by E. W. Parker, chief statistician of the United States Geological Survey, which will soon be ready for distribution. It appears that the world's production of coal in 1906 amounted to about 1,106,478,707 short tons, of which the United States produced 414,157,278 tons. Since 1868, during a period of thirty-nine

years, the percentage of the world's total coal produced by the United States has increased from 14.32 to 37, and this country now stands far in the lead of the world's coal producers. It has been only eight years since the United States supplanted Great Britain as the leading coal producer, yet the increase in this country has been so enormous that Great Britain can no longer be classed as a competitor. In 1906 the United States produced 43.7 per cent. more coal than Great Britain and 85 per cent. more than Germany. Exclusive of Great Britain the United States in 1906 produced more coal than all the other countries of the world combined. It may also be noted that more than 96 per cent. of the world's production of coal is mined in countries lying north of the equator, the countries south of the line contributing less than 20,-000,000 tons annually.

The Allahabad *Pioneer Mail*, as quoted in *Nature*, states that the programs of work of the various scientific departments for the current year, as settled by the Indian Board of Scientific Advice, have been published. The following points are of general interest: (1) Schemes have been completed for the establishment of a central research station and agricultural colleges at Poona, Lyallpur, Cawnpor, Bhagalpur, Coimbatore, Nagpur and Mandalay, and a staff of three European specialists has been sanctioned for each; (2) new agricultural stations are to be started (*a*) at Aligarh for the improvement of cotton, (*b*) at Partabgarh for the study of rice and sugarcane, (*c*) at Jullundur, (*d*) at Bassein, and (*e*) at Bhagalpur and Bankipur (Bengal). The special investigations connected with the improvement of Indian cottons and wheats will be continued, but the scheme for the improvement of Indian tobacco will largely remain in abeyance until the appointment of a specialist for this purpose. The study of sugar-cane diseases and of practical measures for the suppression of cotton boll-worm in the Punjab will also be continued. The lead mines of the southern Shan States, the tin deposits in Mergui, Tavoy and Karenni, the oil beds in the Irrawaddy Valley and the Arakan districts, the volcano of Popa in the Myingyan district, Burma, the copper beds of Singhbhum, and the manganese mines in the central provinces, are all to be the subject of geological investigation.

UNIVERSITY AND EDUCATIONAL NEWS

By the will of the late D. Willis James, of New York City, the sum of one million dollars divided into ten portions of $100,000 each, is bequeathed to educational and charitable institutions, the former being: Columbia University, Yale University, Amherst College, Union Theological Seminary, Cooper Union and the Hampden Institute.

Miss Anna T. Jeanes has bequeathed practically all her estate, said to be of the value of $5,000,000, for public purposes, including the establishment of a hospital. A bequest of certain property, estimated to be between $500,000 and $3,000,000 in value, has been bequeathed to Swarthmore College on condition that it abandon intercollegiate sports. A committee of the board of managers has been appointed to report on the question.

The buildings of the Barnard Medical College and the Centenary Hospital, St. Louis, valued at $300,000, have been transferred to the University of Missouri, which expects to provide the two final years in medicine at St. Louis, after 1908.

A cablegram from Tientsien states that an imperial edict decrees compulsory education for everybody in China, and adds, furthermore, that the people are to be taught the principles of constitutional government, in order that they may be better fitted to elect representatives when a parliament is created. The throne expresses anxiety to establish parliamentary institutions, but adds that the success thereof depends upon the education and knowledge possessed by those called upon to govern.

A new university library, to cost one million Marks, will be erected in Tübingen.

The name of the high school in Münster was changed on August 22, to "Wilhelms Westfalian University." A school of medicine will be established.

THE University of Cincinnati has established two new chairs of full rank since the beginning of the last academic year; the chair of political and social science, not yet filled, and that of geology and geography, filled by the selection of Professor Nevin Melancthon Fenneman, Ph.D., lately professor of geology in the University of Wisconsin. The successor of Professor Thomas Evans, head of the department of chemistry, whose death occurred in the early summer, is Professor Lauder William Jones, Ph.D., lately instructor in chemistry in the University of Chicago. Two professors have been retired on the Carnegie Foundation: Edward Miles Brown, English, and Wayland R. Benedict, philosophy. The former's successor has not been chosen and Associate Professor George Morey Miller is in temporary charge of the department. The new professor of philosophy is H. Heath Bawden, Ph.D., lately of Vassar College. The following appointments of assistant professors have become effective: John J. Porter, M.E., assistant professor of metallurgy; Alice C. King, M.A., assistant professor of elementary education; Frank W. Ballou, B.S., assistant professor of the history and principles of education. Professors Louis Trenchard More, physics, and Marco F. Liberma, Romance languages, have returned from leaves of absence of one year, spent in Europe.

AT the University of Missouri, F. W. Liepsner, assistant in chemistry, has resigned to accept an instructorship in chemistry at the University of Virginia, and Philip L. Gile, assistant in agricultural chemistry, has resigned to accept a position in the new government laboratory in Porto Rico. Dr. Herman Schlundt has been promoted to be professor of physical chemistry. The following new appointments have been made in chemistry: Dr. P. F. Trowbridge, assistant professor of agricultural chemistry; Norman D. Hendrickson, C. R. Moulton and L. F. Shackel, assistants in agricultural chemistry; J. A. Gibson, instructor in analytical chemistry; Merle Randall, assistant; R. M. Smith, student assistant in organic chemistry; Clarence Estes, problem reader. Dr. R. B. Gibson has been appointed instructor in physiological chemistry (department of physiology).

PROFESSOR LEWIS E. YOUNG, formerly professor of mining and metallurgy at the University of Colorado, has succeeded Professor Geo. E. Ladd as director of the Rolla School of Mines.

DR. FRANKLIN HAMILTON, pastor of a methodist episcopal church at Boston, has been elected chancellor of the American University at Washington.

DR. H. D. SENIOR, associate in anatomy in the Wistar Institute, Philadelphia, has been appointed professor of medicine at Syracuse University.

PROFESSOR DOUGLAS W. JOHNSON has resigned his assistant professorship in the Massachusetts Institute of Technology, to accept an appointment as assistant professor of physiography in Harvard University. The latter appointment was made a year ago, but during the past year Professor Johnson continued to give instruction in the geological department of the institute, his resignation taking effect September 1 of the current year.

BERTRAM G. SMITH has resigned his position as instructor in biology in Lake Forest College to accept an appointment as instructor in zoology in Syracuse University. Arthur B. Clawson, formerly assistant in zoology in the University of Wisconsin, will succeed Mr. Smith at Lake Forest.

GRADUATES of Harvard University in zoology have accepted appointments as follows: A. M. Banta, Ph.D. ('07), professor of biology at Marietta College, Marietta, O., to succeed Professor T. D. Biscoe, retired; H. S. Davis, Ph.D. ('07), professor of biology in the University of the State of Florida, at Gainesville, Fla.; Calvin O. Esterly, Ph.D. ('07), professor of biology in Occidental College, Los Angeles, Cal.; W. M. Barrows, S.M. ('06), assistant in zoology at the New Hampshire State Agricultural College and Experiment Station, Durham, N. H.; Donald W. Davis, A.B. ('05), associate professor of biology at Sweet Briar Institute, Sweet Briar, Va.; W. G. Vinal, S.M. ('07), instructor in biology at Marshall College, Huntington, W. Va.